Metallurgical Reliability Issues in Flip Chip Technology

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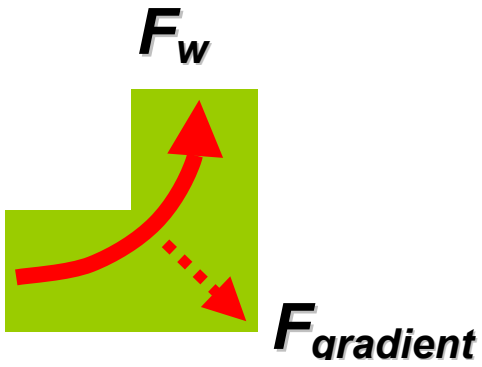
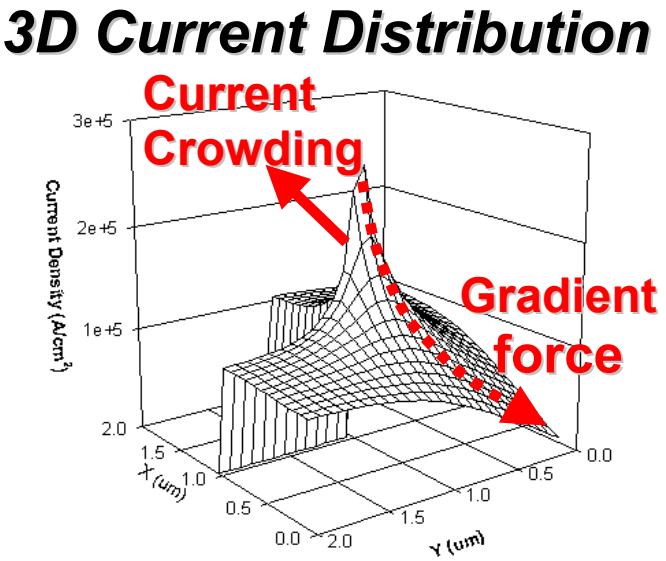
Electromigration in Flip Chip Solder Joints

- **Current density**: 10^3 to 10^4 A/cm^2
- **Temperature**: Room temp. to 150 °C
- **Diffusivity**: 10^{-11} to 10^{-8} cm^2/sec in eutectic SnAgCu
- **Current crowding**: Current density changes by a factor 50, from Al interconnect to solder bump
- **Gradient force**: Normal to current flow





♦ K. N. Tu, E. C. C. Yeh, C. Y. Liu, and Chih Chen, "Effect of current crowding on vacancy diffusion and void formation in electromigration," Appl. Phys. Lett. **76**, 988-990 (2000).

♦ E. C. C. Yeh, W. J. Choi, K. N. Tu, P. Elenius, and H. Balkan, "Current crowding induced electromigration failure in flip chip solder joints," Appl. Phys. Lett., **80**, 580-582 (2002).

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Training

1 post-doc, Dr. Everett C. C. Yeh, worked on
simulation of current distribution in VLSI structures,
now working in Intel, San Jose, CA

1 new post-doc, Dr. X. Zhang, will join the group in September 2002
to work on quantum mechanical theory of current crowding

4 graduate students in experiments on electromigration
in solder joints and lines
2 Ph. D. students (Woojin Choi and Ms. Hua Gan will graduate in summer of 2002, both of them have presented papers in TMS, ECTC and SRC meetings)
2 M. Sc. Students (Q. T. Huynh graduated in 2001 now working in Intel, Alhambra, LA; Ms. Gu Xu will graduate in June 2002)

A new Ph. D. student, Albert Wu has joined the group to work on electromigration

3 undergraduate students, Fiona Ku, Jennifer Guhit, and Elaine Bernal worked on experiments on flip chip reliability

Taken on June 2001